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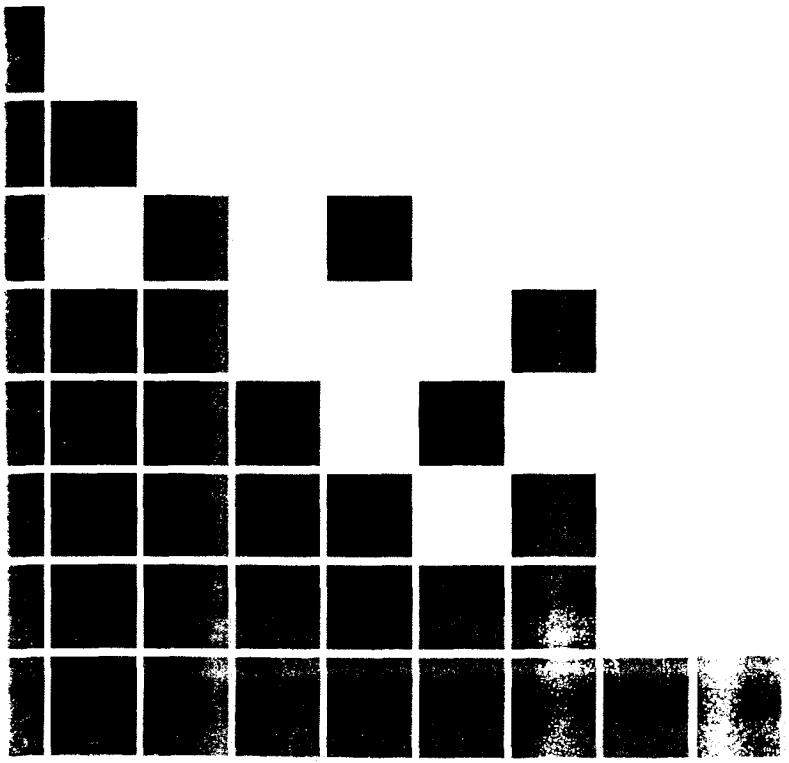
CIAR

■ CENTER FOR INDOOR AIR RESEARCH



1994 RESEARCH AGENDA

REQUEST FOR APPLICATIONS

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Source: https://www.industrydocuments.ucsf.edu/docs/shjl0000

Mission Statement

The mission of the Center for Indoor Air Research is to sponsor high quality research on indoor air issues and to facilitate communication of research findings to the broad scientific community.

Science Advisory Board Members

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Virginia Polytechnic Institute and
State University

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January, 1994

Dear Investigator:

I am pleased to provide you the Center for Indoor Air Research's "Request for Applications" booklet. This package includes information about the Center, the research and review process, procedures for application, the contract management process and the application forms. Also included is our Research Agenda which describes CIAR's research interests.

Applications must be received by June 1st. Funding of awarded projects begins the following January 1st. Please complete and return the enclosed checklist along with the contract application materials.

If you have additional questions concerning application procedures, please contact the Center at (410) 684-3777.

Thank you for your interest.

Sincerely,

Max Eisenberg

Max Eisenberg, Ph.D.
Executive Director

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Center for Indoor Air Research

The Center for Indoor Air Research (CIAR) is a non-profit corporation formed in March, 1988 to sponsor high quality research on indoor air issues and to facilitate communication of research findings to the broad scientific community.

The Center has three classes of membership: charter members, regular members and associate members (See Appendix A). The charter members are those corporations that established the Center and are currently providing the majority of the funding. Regular and associate members are those persons or corporations that are interested in indoor air quality research but were not involved in the establishment of the Center. The regular members are represented on the Board of Directors while the associate members are not. The Center is actively seeking additional members in both the regular and associate categories. Additional information on membership can be obtained by contacting the Center.

The Center has established a Science Advisory Board (SAB) which develops the research agenda for approval by the Board of Directors. The SAB recommends proposals for funding after they have been peer reviewed by the Center's pool of peer reviewers. This structure ensures that only high quality research which will contribute to the knowledge bank on indoor air is recommended for funding.

Research and Review Process

The research agenda of the Center for Indoor Air Research is formulated by the Science Advisory Board (SAB), a multi-disciplinary group of individuals with reputations for expertise and scientific leadership in the disciplines relevant to indoor air research. The SAB seeks the best judgments of active research scientists as to what scientific information is missing in the various disciplines before independently ascertaining the research priorities of the Center.

After the SAB establishes the research agenda, the Center announces to the scientific community at large that research applications in response to the agenda are being accepted. The review of proposals and their selection for funding is accomplished in a scientifically rigorous and objective manner. Applications are reviewed first for scientific quality by the applicant's peers selected from the group listed in Appendix B. The SAB, in turn, reviews the applications and peer evaluations, and develops recommendations on the selection of applications. Studies recommended by the SAB are subject to final approval by the Board of Directors.

A staff scientist is assigned to each funded project to monitor the investigator's progress and to provide assistance to the investigators toward the successful completion of the project.

When a project is completed, the investigator submits a draft final report which is reviewed by the Center for its scientific quality and soundness of conclusions. The investigator is encouraged to publish the work in an independent, peer reviewed journal for the benefit of the scientific community at large.

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Request for Research Applications

Introduction

The Center for Indoor Air Research was established in 1988, as an independent, non-profit corporation. Its primary purpose is to sponsor scientific and technical research on the sources, transformation and fate of constituents affecting indoor air quality; on factors governing human exposure to, and retention of those constituents; on the effects of those constituents on health, including exposure-response relationships; and on methods of preventing or abating indoor air contaminant concentrations. The research program will be supplemented by periodic conference workshops and commissioned monographs.

A Science Advisory Board has been assembled to assist in the formation and review of the research program. The Advisory Board consists of eminent scientists from a range of disciplines, including environmental engineering and monitoring, chemistry, toxicology, microbiology, epidemiology and biostatistics.

The following research agenda was established at the Center for Indoor Air Research Science Advisory Board (SAB) Workshop, held in June, 1991. Research topics of major interest to the Center are described in the agenda. Individuals who intend to apply for funding are encouraged first to submit a letter of intent, two-to-three pages in length, indicating the research objectives, key elements of the experimental design and methods, estimated time required and approximate direct and indirect cost. The letter should be addressed to:

Center for Indoor Air Research
1099 Winterson Road, Suite 280
Linthicum, Maryland 21090

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Research Agenda

In the research agenda that follows, the Center's priorities and specific requests for application are presented. These represent the Center's best judgment on currently important research problems, but the agenda is by no means exhaustive. As stated in the Introduction, any proposal that is consistent with the Center's purpose will be considered. Our objective in presenting priorities and research topics is to stimulate researchers to focus on problems related to indoor air quality (IAQ).

The research needs that follow are grouped according to **sources** investigations, **exposure/dose** assessment, **health effects, perception** of IAQ, and **engineering control strategies** for IAQ. This collection of topics represents one general approach to indoor air quality research. Numerous indoor air contaminants warrant investigation in terms of their fate and transport in the indoor environment, the forms and quantities in which they present themselves to exposed individuals, the dose actually delivered to a target (e.g., individual, organ, cell), strategies to reduce their levels, and the perception of indoor air quality in the presence and absence of the contaminants. Some contaminants of interest are volatile organic compounds (VOCs), environmental tobacco smoke (ETS), and biological aerosols (aeroallergens and aeropathogens). CIAR does not plan to support research on asbestos and radon because other organizations already fund large efforts on these topics.

Indoor air quality is "the nature of air that affects the health and well-being of occupants" where, according to the World Health Organization, "health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity". CIAR is interested in all relevant chemistry, physics, control strategies for, health effects caused or aggravated by, and psychosocial factors influencing the perception of indoor air quality. Due to the interdisciplinary nature of indoor air research, most projects will encompass more than one of these areas. CIAR, therefore, encourages interdepartmental collaborations and joint projects whenever they serve to enhance the interpretation and evaluation of results or to strengthen the validity of conclusions.

Sources

Myriad substances in indoor air have potential to affect health. The sources are many (e.g., outdoor air, people and their activities such as cooking, consumer products including pesticides, heating and cooling systems, building materials, electronic equipment) and distributions of sources and chemicals vary among indoor environments. For example, certain chemicals might be added to heating/cooling systems to exert a biocidal or preservative effect. The fate and effects of such known-source agents have not been studied extensively. Many constituents are being studied within risk assessment frameworks as toxicologically-significant compounds; however, much work remains to be done in characterizing distributions of various agents in specific environments related to sources and assessing their impact on human health.

CIAR is interested in creative proposals to:

- Develop methods to characterize and quantify source emissions. Research in this area could include biologically-based means of source characterization and product screening, such as human irritation and odor assays, as well as development/improvement of chemical analytical methods.
- Investigate the transport and environmental fate of indoor air contaminants, particularly via sinks. This work will elucidate indoor air chemistry, and is important in determining concentrations for short and long-term exposure estimates.
- Develop and validate models to relate source emissions, fate, and transport.

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Numerous biological agents in indoor air may cause human disease, including immunological disorders and respiratory infections. The most common biological agents found in indoor environments are bacteria, viruses, fungal spores, algae, arthropod fragments and droppings, and animal dander. Proliferation of microorganisms is dependent on moisture level and temperature. These requirements for growth are often provided by heating and air conditioning systems, and humidifiers.

Research proposals are requested on the following:

- Develop sampling methods amenable to standardization for the characterization of microorganism concentrations in the indoor environment.
- Characterize the size-segregated distribution of specific antigens in various indoor environments. Attention should be paid to factors influencing the distribution of the antigen in settled dust and as airborne particles.

The air in virtually all indoor environments is a complex mixture of low levels of both reactive and unreactive species which may interact chemically or physically in a dynamic equilibrium between gaseous and particulate phases. The physical and chemical natures of the species themselves as well as those of the surrounding environment could affect the composition of the air to which an occupant is exposed. For example, does the presence of moisture lead to chemical reactions with indoor air constituents? How and to what extent do different types of building materials and surfaces influence the fate of indoor contaminants?

- Elucidate the dynamics of complex physicochemical mixtures typical of indoor environments.

Exposure Assessment/ Dosimetry

The estimates of exposure and internal dose are critical factors in the reliability of studies to determine the health consequences of exposures. There are two critical issues in exposure-dose relationships: the effect of aerodynamic respiratory tract defenses in altering the quantity and distribution of the exposure to achieve a tissue dose, and measurement of actual internal dose. The complex particle-gas composition of indoor air contaminants has an important effect on the pulmonary distribution of the inhaled exposure.

Measurements from site-specific and personal monitoring including biomarker measurements, are more reliable than self-reported history of exposure. In epidemiological studies, inaccurate reports of exposure history introduce misclassification bias. In field studies, the use of inaccurate estimates of exposure can lead to variable, unreliable dose- response data. Appropriate modeling may estimate dose from exposure. Biomarkers can be useful in studying tissue injury and to determine dose from the low levels of exposure common indoors.

Applications are requested for the following:

- Clarify the relationship between exposure and dosimetry by conducting studies to improve the use of biomarkers together with exposure monitoring and health effects. This effort would involve improvements in pharmacokinetic modeling as well as methods development for exposure research.

  Particular areas in which there are limited data are:
  - personal monitoring in non-industrial occupations and in high risk groups;
  - time-activity profiles in exposure studies.

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- Develop unique, new biomarkers with the sensitivity and specificity to be useful in studying injury in both animals and humans.
- Develop bioassays for detection of biological markers for exposure, effect, and susceptibility.
- Investigate the use of polyclonal antibodies for screening in exposure-dose studies.
- Develop and validate models to predict dose and allow for extrapolation between animals and humans.

Health Effects/Responses

Low levels of airborne species may mediate lung injury by effects related to cumulative dose or long-term dose rather than peak dose. This concept is well-established for lead, where total dose is as important as dose pattern.

Although there is growing agreement regarding the techniques used to measure indoor contaminants, there remains the problem of whether point or time-weighted measures are most meaningful. Given a specific indoor environment with a characterizable distribution of airborne substances, do measureable health effects relate to cumulative, chronic, low-level concentrations, to acute peak concentrations, and/or to synergistic effects between substances?

CIAR is interested in considering creative proposals to:

- Investigate the effects of long-term steady exposures to non-peak or low levels of indoor contaminants in order to determine whether or not realistic indoor levels of these chemicals contribute to overall adverse health effects.

While many chemical constituents have been identified in indoor air, little is known about the chemical changes that occur therein and the mechanisms by which they occur.

The chemical fate of single species and their resulting impacts on health could vary greatly in different complex environments. For example, does the presence of an airborne contaminant or reaction intermediate alter the tissue dose and physiological responses to other indoor air contaminants?

CIAR will consider creative proposals to:

- Elucidate the health responses of interactive, low-level, complex exposures.

Studies of the relationship between indoor air contaminants and **precisely defined** clinical diseases are encouraged. Health effect/response questions of interest to CIAR include:

- Do inhaled indoor contaminants impair cardiovascular performance and contribute to the incidence of angina and myocardial infarction?
- Do inhaled indoor contaminants initiate or aggravate bronchial hyperreactivity in asthmatics and/or the normal population?
- Do inhaled indoor contaminants affect resistance to respiratory infection?
- Do inhaled indoor contaminants affect prenatal and perinatal development?

CIAR requests applications to:

- Perform studies to determine the effects of indoor contaminants on cardiovascular, pulmonary, and immune system function.
- Investigate host susceptibility factors for effects due to inhalation of indoor contaminants.

CIAR is interested particularly in the long-term consequences of **low level exposures**.

Biological agents may cause allergenic or pathogenic responses. Indoor allergens, including those present in animal dander and arthropod fragments and droppings, appear to be ubiquitous. Virtually all homes studied, whether or not pets have been present, have exhibited allergens. Such allergens are risk

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factors in both the development of asthma and provocation of acute asthmatic attacks. Avoidance of the allergens has been associated with improvement in the clinical status of asthma. The extent to which the risk imposed by specific allergens is determined by their aerodynamic characteristics and airborne concentrations is uncertain. A variety of microorganisms including fungi, bacteria, nematodes and amoebae have been implicated as producers of sensitizing antigens responsible for the development of acute and chronic forms of immunologically mediated disease. Elevated humidity and moist surfaces promote the growth of the parent organisms. The role of aeropathogens in inducing allergenic rather than pathogenic responses is an area of interest to the Center.

- Conduct highly-focused studies of aeropathogens (endogenous bacterial and fungal flora found in specific environments which induce allergenic rather than pathogenic responses. Proposed studies in this area should be promising with respect to yielding productive, new results.
- Relate such health responses to indicators of host susceptibility.
- Develop immunological and biochemical markers that best characterize susceptibility and response.

Perception of IAQ

A basic objective of environmental control is to provide for the comfort and health of occupants. Investigators have not always been able to identify specific contaminants responsible for reported health complaints, the most prevalent being eye, nose, and throat irritation. While considerable progress has been made in the development of technology to measure contaminant concentrations, greater effort is needed in quantifying human responses to indoor air environments. Studies to date have shown that worker health in office buildings, for example, is influenced by individual, perceptual, psychosocial, and psychophysical factors.

CIAR requests applications for research to:

- Elucidate the relationship among disorders expressed by occupants in buildings and the importance of perception. Determine the baseline rates of symptom reporting under various, well-documented circumstances. This research would most likely involve the development of improved sampling strategies for surveying building occupants and improved self-reporting measures, interview techniques, and other approaches to assess occupants' health problems.
- Develop convenient, objective ways, based on physiological or biochemical measurements, to assess irritation and to validate symptoms of irritation. Improve the sensitivity of existing indices of eye, throat, and nasal irritation.
- Explore the basis for individual and group differences in perceptual sensitivity and annoyance to indoor contaminants. Relevant factors could include age, sex, and personal history of smoking behavior, allergy, and respiratory infection.
- Develop and validate a predictive human structure-activity model for irritants. Explore the potential for extrapolating the existing structure-activity data for irritants in animals to humans.

Engineering Control of IAQ

The decrease of indoor contaminants most probably will lead to reduction of adverse health effects. The choice of an engineering control strategy depends strongly on the psychosocial and psychophysical influences described above as well as the measurable environmental contaminant concentrations. Therefore, development of "healthy building characteristics" involves knowledge of both the physical environment and occupant responses.

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Applications are requested for:

- Developing engineering strategies to control either indoor comfort parameters or indoor air quality parameters, or both. Strategies that enhance the welfare of occupants (comfort parameters) and their health (indoor air parameters) are preferred to controls that address just one or the other.
- Developing engineering control strategies to reduce occupant exposures to indoor air contaminants in office buildings and in residences. Develop protocols to assess the efficiency of each proposed strategy.
- Developing criteria and standards for the design of spaces to be occupied and for design of control systems, to minimize or mitigate indoor air quality problems.

Application Process

LETTER OF INTENT: CIAR requests submission of a two to three page letter of intent, including a synopsis of the proposed research with reference to the project's specific goal(s), the general approach to be used, identification of all participating institutions and an estimate of the total monies that will be requested. These letters will be used to plan the proposal review process. The letter of intent is not binding on CIAR or the applicant. This letter should be received no later than thirty (30) days prior to the deadline for submitting applications, at the following address:

Center for Indoor Air Research
1099 Winterson Road, Suite 280
Linthicum, Maryland 21090

CIAR will notify the applicant if a full application is not warranted.

FORMAT: Applications must be submitted on the attached "Application for CIAR Research Contract". Investigators should review the **Application for CIAR Research Contract General Information and Instructions** found on pages 11 to 13. Inquiries regarding application procedures and review procedures may be directed to the Center at the above address or by calling (410) 684-3777. If two applications are interdependent or closely related, they should be appropriately cross-referenced in the project plan.

Ten copies of the abstract and ten (original and nine) copies of the application (including abstract) are needed by CIAR for the review process.

Each copy of the application, except the original, should be placed in a binder with a label containing the title of the proposal and the principal investigator's name.

DEADLINES: Applications must be postmarked by June 1. Proposals not meeting this deadline will be held for the next funding cycle.

Management of Research Contracts

Research Agreements

The Center for Indoor Air Research awards contracts, renewable annually for the number of years approved by the Board of Directors if work is progressing satisfactorily. The Research Contract has been designed to maximize the integrity of the scientific process while providing needed protections and meeting applicable regulations. Proposals and any addenda or modifications will be appended and made part of the contract.

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Progress Reports

Investigators are required to submit progress reports at five months and ten months of each contract year, except for the last year of the project, when the final report is substituted for the usual ten-month report. These reports are reviewed by the project monitor.

The basic objective of the five month report is to indicate how much progress has been made in the development of experimental procedures, which objectives have been completed, and what problems, if any, have arisen. The ten-month report is actually a combined progress report and renewal application for the next year's funding. CIAR's decision regarding renewal of the contract is based upon the information provided by the investigator in this report. The ten-month report should provide a detailed account of experimental results obtained during the funding period, as well as a discussion of specific objectives for the coming year and a budget.

Site Visits

CIAR staff (project monitor) usually conducts site visits to the laboratories of its funded investigators during the project period. The purpose of these visits is to evaluate the status of the project, and to provide an opportunity for an exchange of ideas between the investigator and CIAR scientists.

Final Report

As part of the research project, the investigator prepares a final report which describes the study and its findings. The investigator's draft final report is reviewed by the project monitor. Some reports are reviewed also by peers who represent a broad range of relevant experience. The objective of the CIAR review process is to ensure that the Investigator's Report is complete, precise, and understandable. Review comments may be sent to the investigator who then has an opportunity to respond to the comments and, if necessary, to revise the report. Guidelines for the preparation of final reports to CIAR appear in Appendix C.

Publications

It is the policy of the Center to strongly encourage investigators to publish results of research conducted with CIAR funds in the open scientific literature. The following statement, acknowledging CIAR support, should appear in all publications resulting from work funded by CIAR:

> "Research described in this article was supported (in part) by the Center for Indoor Air Research."

Original reprints of all journal articles, copies of abstracts, and review articles describing CIAR-funded research should be sent to the Center.

Contract Administration Policy

Payments will be made quarterly to the institution where the research is being conducted. A payment schedule other than quarterly must be requested and approved by the Center prior to commencement of a contract. Payments are made upon receipt of an invoice from the institution.

It is the Center's policy to permit quarterly billing of 22.5% of the total contract less equipment. Ten percent of the total contract amount is withheld pending receipt and acceptance of the ten-month/final report by the Center. Equipment should be invoiced in the quarter in which it is purchased.

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Contracts may not be transferred from one institution to another due to a change in affiliation by principal investigator without express permission of the Center.

A Contract may be terminated prior to normal expiration date by the contractor upon notification to the Center with a statement of reasons for termination.

Unexpended funds shall be returned to the Center for Indoor Air Research either upon expiration or termination of the project.

Budgets are presumed accurate at the time of award; however, up to 20% of the funds may be reapportioned among all categories, except for travel, without prior approval. If, for any unforseen reasons, additional funds or reapportionments exceeding 20% are required, such requests will be considered by the Center upon receipt of a complete statement of reasons for such change. **PLEASE NOTE:** If funds are reapportioned into category (g), equipment, and/or category(f), subcontracts, subsequent reduction in category (i), indirect costs, will result and, thus, reduction in the total project award.

Application for CIAR Research Contract

General Information and Instructions

Submission of Applications

Complete applications received by the June 1st postmark deadline will be reviewed. Funding of awarded projects will begin the following January 1st.

Submit the original and nine additional copies. If photographs are included, send one original set. Submit ten additional copies of the Research Abstract form.

Append as much material as required. Type, single space, using 8 1/2" x 11" paper and label each sheet with the name of the Principal Investigator in the upper right hand corner. Number each page consecutively beginning with page 4. DO NOT insert pages between form pages F1 and F3.

Investigators will receive written acknowledgement of receipt of the application.

Research Plan

8. *Aims*

   State the objectives of the research and the hypotheses you will test.

9. *Significance of Proposed Work*

   Identify gaps in the research area and discuss pertinent background material that supports the importance of the work.

10. *Preliminary Studies*

    Critically evaluate existing knowledge pertinent to the application with reference to the key literature. Provide an account of the principal investigator/program director's preliminary studies pertinent to the application and/or any other information that will help to establish the experience and competence of the investigator to pursue the proposed project.

11. *Experimental Design and Methods*

    Outline the experimental design and the procedures to be used to accomplish the specific aims of the project. Include the means by which the data will be collected, analyzed, and interpreted. Include a description of the statistical methods to be used for analysis and interpretation of the data. Describe the proposed statistical procedures with sufficient detail to allow evaluation by a biostatistical reviewer. Describe any new methodology and its

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advantage over existing methodologies. Discuss the potential difficulties and limitations of the proposed procedures and alternative approaches to achieve the aims. Provide a tentative sequence or timetable for the investigation (i.e., a columnar or graphical representation of your schedule for completion of tasks). Point out any procedures, situations, or materials that may be hazardous to personnel and the precautions to be exercised. Provide a list of literature you cited in your application.

13. *Other Support*

List all currently active and pending support for all key personnel involved in this proposal. Include the source of support, percentage of appointment, dates of project period, a brief description of the project and whether it overlaps, duplicates, replaces, or supplements this proposed work in any way.

14. *Budget*

Cost Data: Provide sufficient detail and analysis to assure the Center that the proposed costs are reasonable and that adequate accounting procedures will be used. CIAR has no specific limitation on the budgets of research proposals. Most contracts are expected to be in the range of $50,000 to $200,000 per year, including overhead. Projects requiring larger budgets must have exceptional promise for developing important methods or information for understanding indoor air quality.

Personnel: List the names and positions of all applicant organization personnel involved in the project for which salaries are requested. Note those which are considered essential to the project. Estimate the percentage of time or effort on the project for professional personnel and non-professional personnel. List the dollar amounts separately for each individual for salary and fringe benefits. Fringe benefits may be requested to the extent that they are treated consistently by the applying organization as a direct cost to all sponsors.

Consultant Costs: Consultant service should be explained by indicating the specific area in which such service is to be used. Identify the contemplated consultants. State the number of days of such services estimated to be required and the consultant's quoted rate per day.

Equipment: If special-purpose equipment is being proposed, provide a description of the item(s) and details of the proposed cost. If fabrication by the applicant is contemplated, include details of material, labor, and overhead.

Alterations and Renovations: If the costs of essential alterations of facilities, including repairs, painting, removal or installation of partitions, shielding, or air conditioning, are requested, itemize them by category and justify them fully.

Supplies and Other Expenses: All supplies and other expenses should be itemized in sufficient detail to allow reviewers to understand the major categories of expenditures (i.e., animals, glassware, media chemicals, as well as publication costs, page charges, and books, listed by category and unit cost). Itemize and justify such items as patient travel and per diem costs, rentals, leases, and computer costs. Unusually expensive items for special processes should be separately identified by quantity and price and the use or application thoroughly explained in the project plan. Each individual expense item must be categorized as supplies or other expenses according to the practices of the accounting office of your institution.

Travel Expenses: Indicate the estimated number of trips required, destination, reason for travel, and cost. Identify and support any other special transportation costs

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attributable to the performance of this project. CIAR pays for foreign travel only if it is approved in advance of the trip.

Subcontracts: Itemize and enter a total for these costs. Describe and justify all appropriate costs for services purchased for, or associated with, third parties.

Indirect Costs: Indirect costs are limited to a maximum of 25 percent of budget items, excluding sub-contracts and equipment on which no indirect costs are payable.

Human Subjects: The Center requires that Institutional Review Board approval for any procedures involving human subjects must be submitted with the application.

Laboratory Animals: The Center endorses the NIH policies on the care and use of laboratory animals, and requires that any proposed experiment involving the use of experimental animals be approved by the Institutional Animal Care and Use Committee at the investigator's institution. Documentation of approval by the local animal care committee will be required.

Research Abstract: A concise, descriptive summary of the project must be submitted with the application. A form is provided for this purpose.

Completeness to Applications: Provide all information requested. The signature and typed names of the institutional officer and principal investigator must be on the application.

Notification After Review of Application: Investigators will be notified in writing, of the decision on their proposal.

Mailing Instructions: Include nine copies and an original of each and every part of the application, plus ten additional copies of the Research Abstract form.

NOTE: Each of the nine copies must be placed in a binder with a label containing the title of the application and the name of the principal investigator. Mail the application to:

Center for Indoor Air Research
1099 Winterson Road, Suite 280
Linthicum, Maryland 21090

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Appendix A

CIAR Membership

CHARTER MEMBERS

Philip Morris U.S.A.
R.J. Reynolds Tobacco Company
Lorillard Corporation
Svenska Tobaks AB

REGULAR MEMBERS

Hoechst Celanese
Mead Paper

ASSOCIATE MEMBERS

Dibrell Brothers, Inc.
Ecusta, Division of PH Glatfelter Company
J.W. Fergusson, Inc.
International Paper
Monk Austin
Mundet International Ltd.
Quest International Flavors, USA
Shorewood Packaging
Somerville Packaging Corp.
Standard Commercial Corp.
United Technologies Carrier Corp.
Universal Corporation
Zeneca Specialty Ink

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Appendix B

CIAR Peer Reviewers

Gerald Akland
U.S. EPA

Janet Arey
University of California, Riverside

Steven D. Aust
Utah State University

Rebecca Bascom
University of Maryland

M. A. Benjaminson
Touro College

Janet Benson
Lovelace ITRI

Malcolm N. Blumenthal
University of Minnesota

William K. Boyes
U.S. EPA

Terry Brennan
Camroden Associates

Ronald P. Brown, Jr.
ISLI/Risk Science Institute

Klaus Brunnemann
American Health Foundation

Harriet Burge
Harvard School of Public Health

Gary R. Burleson
U.S. EPA

Robert Burrell
West Virginia University Medical Center

Robert Bush
University of Wisconsin Hospital

Silvana Camboni
The Ohio State University

Tom Carew
University of California

Neal Castagnoli, Jr.
Virginia Tech

Lony C. Castro
UCLA School of Medicine

Jeffrey Cheek
University of California, Davis

Bean T. Chen
Lovelace ITRI

Leslie L. Christianson
University of Illinois, Urbana-Champaign

Theodore Colton
Boston University School of Public Health

Emanuela Corsini
NIEHS

Daniel L. Costa
U.S. EPA

Derek J. Croome
University of Reading - UK

William E. Crouse
CIIT

Ron Daniele
Hospital of University of Pennsylvania

Salil K. Das
Meharry Medical College

R. Del Delumyea
Jacksonville University

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Mirjana Djordjevic
American Health Foundation

Douglas W. Dockery
Harvard School of Public Health

Richard L. Doty
University of Pennsylvania Hospital

Russell T. Dowell
University of Kentucky

Kevin Driscoll
Procter & Gamble

Bonnie Dunn
FDA

Ed Edney
U.S. EPA

M. Samy El-Shall
Virginia Commonwealth University

Robert C. Elston
LSU Medical Center

Henry M. Fales
National Institutes of Health

Mark W. Frampton
University of Rochester Medical Center

B. Magnus Francis
University of Illinois

Robert Frank
The Johns Hopkins University

Donald Gardner
ManTech Environmental Technologies, Inc.

John Gatley
Brookhaven National Laboratory

Jeffrey Gearhart
ManTech Environmental Technologies, Inc.

Robert C. Gesteland
University of Cincinnati

Thomas V. Getchell
University of Kentucky

Roger Giese
Northeastern University

Matthew Ian Gilmour
U.S. EPA

Henry Gong, Jr.
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